```
**********************************************************************
*                                                                    *
*          QQQQQQQQ        ZZZZZZZZZZ      XX      XX               *
*         QQQQQQQQQQ       ZZZZZZZZ          XX    XX               *
*         QQ      QQ             ZZ          XX XX                  *
*         QQ      QQ            ZZ             XXX                  *
*         QQ      QQ           ZZ              XXX                  *
*         QQ    QQ QQ         ZZ               XX XX                *
*         QQQQQQQQQQ         ZZZZZZZZ          XX   XX              *
*          QQQQQQQQ          ZZZZZZZZZZ      XX      XX             *
*                QQ                                                  *
*                                                                    *
**********************************************************************
```

The Journal Covering Amateur Radio & Sinclair Computers
ZX-80; Micro-Ace; ZX81; T/S 1000, 1500, & 2068

2025 O'Donnell Drive

K5XY — Las Cruces, New Mexico — W4GHV/5

Alex. F. Burr — 88001 — Bo Barry

Publisher — Editor

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* QL Observations
* QZX Friends
* Editor's Doings, W4GHV
* Unclassified Ads
* New Field Day Logger, W8NFQ
* Angle of Radiation Calculations, VE1BRA
* Brother EP-44 Typewriter Review, KA2LHO
* Q-Save Filter Circuit, VE1BRA
* Tasprint Sample, KA2LHO
* Gamma Match Design, WB0IKN - 2068 version by WA6DLI
* Publisher's Notes, K5XY
* Binding QZX
* QZX Net Info
* Quotable Quote

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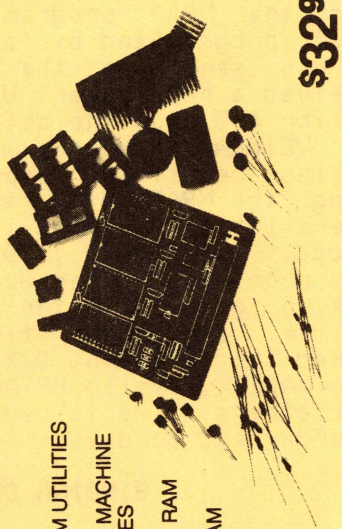

$32.95 plus $1.95 shipping and handling

► *READ THE REVIEWS:*

What a super product!...conceived and executed very nicely...and with quality components. **(SYNTAX QUARTERLY Winter 82)**

8K Nonvolatile memory is a gem! It has so many possible uses...I recommend this board most heartily. **(OKLAHOMA S.U.G. Newsletter 1/3)**

We found the documentation to be far superior to that (of) most hardware we've received. **(S.U.N. Newsletter Nov/Dec 82)**

For versatility this is even better than an EPROM...ranks quite high on the list of "must-haves"... **(SYNC Magazine Mar/Apr 83)**

Provides the user with instant software...an extremely versatile memory extension... **(Z-WEST June 83)**

INTRODUCTION

This memory board is designed to fill the transparent 8K block of memory (from 8K to 16K) in a ZX81-16K system. This area of memory is an ideal place to store, either permanently or temporarily, machine language routines or data which are to be used by the BASIC system.

Sample utilities are included with the kit.

The use of HM6116LP 2K CMOS RAM memory IC's with their own reserve power supply means that routines stored in the RAM are nonvolatile — the RAM retains its memory even when the ZX81 is switched off or reset. Moreover, being RAM, the routines you store in the memory are easily modified. The lithium cell supplied with the board will maintain sufficient reserve power for almost ten years.

ASSEMBLY

Complete step-by-step instructions in a 20 page manual make assembly of the board easy. The kit (pictured above) is complete with a silkscreened solder-masked printed circuit board; all capacitors, resistors, transistors, sockets, connectors, integrated circuits; and the lithium cell. The board is supplied with one 2K CMOS 6116LP-3 RAM — it will accomodate three more for a total of 8K.

Complete kit with one 2K 6116LP-3	$32.95
Additional three 6116LP-3	~~$16.00~~ 20.00
Bare pc board & manual	$13.05
Kit for EPROM use only	$22.95
Assembled & tested with 2K	$47.95
Assembled & tested with 8K	$65.95
Shipping & handling per order	$ 1.95

Send check or money order to the address below:

HUNTER, 1630 FOREST HILLS DRIVE, OKEMOS, MI 48864

QL OBSERVATIONS

Fred Blechman, noted T/S author (see review in October QZX) has used a British QL to write an extensive review which will appear in another magazine (Modern Electronics). He comments that Sinclair Boston now says that the QL will appear in late spring even though Searle told him in January that it would appear in February. He cannot tell whether the delay is in obtaining FCC interference approval or due to production problems.

Fred comments that, "Searle insists that QL's will be sold here, and that they will not replace the wafer drives with a 3 1/2 inch floppy drive. I see this as a death-knell for the QL in the U.S. The window of opportunity for a wafer-based QL in this country is passed, if it ever existed at all. While I personally have no hang-up with wafers, the American public rejected wafers for disk drives years ago, and is not about to step backward in the face of the coming Atari ST-series and Commodore Amiga.

"The English market loves Microdrives, but the US market has no experience of exposure to them.. Even in England, external floppy disk drives (5 1/4 inch) are being used with the QL. They simply plug into the QL bus!

"I found the QL extremely powerful, and the included software (which will not be called Quill, Abacus, Archive, or Easel in the U.S. because of trademark problems) quite sophisticated and versatile."

PUBLISHER'S NOTES

We lost a large number of subscribers this last month, but there are a large number of encouraging signs. We have received quite a few new subscribers who have been referred to us by our existing subscribers. These efforts are essential to keep our membership up to the point where printing is financially possible. We were particularly encouraged by Hans p Eckert, SM3HBQ, who arranged for a bulk overseas subscription of 25 copies. The savings in postage here is substantial.

It is clear that the numbers of Timex Sinclair owners is large enough to continue to support many programmers and add-on developers. Within the last couple of months we have received many notices of new products for the T/S 2068 and the older models too.

Some readers have urged us to be sure to continue printing material about the T/S 1000 and T/S 1500 as well as the newer T/S 2068. We will be happy to do that because those are the computers which we use most often. But Bo and I are both so busy with this newsletter that we do not have as much time to use and program our computers as we would like. We are very dependant upon you, our readers, to send us ham-oriented programs which you have developed. When you do so, it is important that you send us a tape or readable print out of a complete, running program. If we have to retype a program, errors inevitably creep in.

The post office did it to us again. One thing about doing a lot of mailing is that eventually you find out about some pretty obscure postal regulations. In a effort to keep the postage down, we tried mailing the Canadian issues in a smaller envelope (Canadian rules are that all first class mail must be in envelopes.) Well that effort was a sucess, but they all came back to us anyway. It seems that there is a 10 cent surcharge for all mail of less than one ounce which is more than 1/4 inch thick. (The same surcharge is applied to mail which is too big, too small, and too thin.)

QZX FRIENDS

W0KBS -- Gordon writes that he would like to see more T/S 2068 material. He had success with the TYPE program. He also has an Atari 800xl and says that each computer has its advantages and disadvantages and that he learns from both.

N8BIF -- Terry writes lately I have been occupied with a voice synthesizer based on the Radio Shack allophone chip. It actually works, but is a little difficult to understand. I am also adding a centronics port, prrallel ports, rs232, home burned ROM tape routines, all in a Jameco keyboard box. He had trouble with his ZX printer but sent it to Sinclair Research LTD, Stanhope Road, Camberley, Surry, GU15 3PS, ENGLAND with a 10 pound note and received a new printer within three weeks. He also says that the NRAP program from NU4V is a great program and by far the best thing he has seen for the ZX81. He also received a replacement ULA from Sinclair USA for $15 plus the defective ULA.

VE1BRA -- Murray writes the ZX81 is working beautiful, especially on RTTY using the NRAP software of NU4V. Have made a lot of contacts in North America, Europe, and Africa; DXCC on RTTY looks very promising. The Hunter RAM board is working great with the ZXLR8 fast load routine, and other utilities. He has worked the following QZX friends on RTTY: Mike WA9ESX, Camilo HP1AC, Ted KE5IG, and some others. He is usually on 20 meters Saturday and Sundays.

BINDING QZX

Some subscribers have written asking us to print QZX in such a way that three holes could be punched in the stapled margin so that the issues could be conveniently stored in a three ring binder. The request is a very reasonable one, but it could not be put into practice without significantly increasing

the work load in putting the magazine out; and, as you can see by the date on this issue, the last thing Bo and I need is a bigger work load.

However, I have found just the gadget to solve the problem. There are available in some office equipment stores packets of little plastic strips with three holes on one edge just the right size to fit into a three ring note book. There is a slot on the other edge through which half of QZX can be slipped until the stapled edge reaches the plastic. The result is the same as if you had pasted a strip with binder holes onto the left edge of the magazine. They then all fit micely into a large three ring binder. One set of twelve will hold one year's worth and they can be used over again. They will fit any magazine that is not too thick.

Not every business supply store has this item, so for those who cannot find them nearby, QZX will be glad to provide a year's supply (12 strips) for $3 postpaid.

Editor's Doings - W4GHV

We have finally collected info on all the contributors and you should be hearing from us any day! If we miss anyone or you don't like the 'reward', LET US KNOW, after all we couldn't do it without you! Thanks for all the excellent contributions, and a few OK ones. Don't forget to put in your resumes that you were published in a WORLDWIDE journal.

My most notable accomplishment of late, other than taking long rests when I should be putting together the next QZX issue, has been helping one of my 'star' students with his Timex interfacing projects. He has built the interfaces described in Radio-Electronics a short while back and has learned more debugging it than I was able to teach him in a year! He has the thermometer (A/D) working and was last seen working on a speech synthesizer circuit using the GI chip sold by Radio Shack. Friday he said the chip could only groan, but I bet Monday he will have it talking.

You will note elsewhere in this issue a free ad for some 2068 software. It was sent to us by Bob, WA6DLI, (our reliable mainstay on the west coast). He also sent comments about Omnicalc 2 which he says is the Lotus 1-2-3 of the 8 bit world, with a 5000 cell limit. The rest of his scribbling is Q1 R1 or whatever. The program is for the Spectrum or the 2068 using the Spectrum emulator ROM. The spec sheet he sent for Omnicalc 2 looks impressive to say the least. If you have the correct computer setup and want to experiment with a neat spreadsheet program, it may be for you. I trust y'all (you all for non-Southerners) aren't having trouble finding new software, etc for your computers, I keep coming across new catalogs, programs, etc. If I can find time I'll try to report on what I've found.

QZX Net Info

40 meter - west coast - 10 AM Sat, local time on 7235 MHz. Call WA6DLI-Bob, WA6OUC-Warren, W6AMN-Bob.

UNCLASSIFIED ADS

WANTED: UNCLASSIFIED ADS for publication in QZX. Cost is 1 cent for each keystroke (characters, blanks, etc.). Payment must be included with order. This is an excellent way to sell your program or unwanted equipment, ask for help, or find a specific program. Send your ad with payment to QZX, 2025 O'Donnell, Las Cruces, NM 88001.

FOR SALE: Spectrum owners, work RTTY on a 48K machine. Cassette programs include 7 memories, many data rates. Requires no interface. $17 post paid from Sweden. Hans p Eckert, SM#HBQ, Box 119, S-81300, Hofors, Sweden.

WANTED: Z-80 computer. Working condition. Edward L. Radtke, 1602 Woodluck Avenue, Louisville, KY 40205

FOR SALE: ZX81/TS1000 edgeboard wire-wrap connectors; keyed; bifurcated contacts; manufactured by TI; $5.00 each. Pc piggy-back extender boards; $1.50 each. Economical experimenting with Radio-Shack's 276-158 and 161 project boards and these connectors. Add $0.75 shipping per order. Paul Hunter, 1630 Forest Hills Drive, Okemos, MI 48864.

BUFFERED BUSS expansion board $40 and I/O board $10. Both for ZX81, TS1000, & TS1500 and I/O for TS2068 too. Bare boards ppd with documentation. **Budget Robotics & Computing**, Box 18616, Tucson, AZ 85731.

QUOTABLE QUOTE

The following quote is approximately what was said in a column by Spencer F. Katt, which purports to give the reader inside information on IBM computers. The column is usually interesting, irrelevent, and wrong; but it did say that, for the US, the QL is a computer whose time has come (and passed).

New Field Day "LOGGER" Progam

LOGGER, as it was presented in the July issue, was done entirely in Basic. When used on Field Day, it proved to be a bit slow when checking for Dups, taking as long as 12 seconds when 400+ call signs were in the file. So, I decided that I'd have to learn to program in Z80 Machine Language.

That effort resulted in a new and much livelier LOGGER program. It now takes less than a second to search the entire file. The program is still mostly in Basic but all accessing of the Call Sign file has been converted to Machine Code. The MC is contained in a 200 character long REM statement (program line 1) and the file itself is above RamTop (above address 27946). The file can contain up to 600 call signs, which seems sufficient (at least with our group) for one operating position. Of course, a file above RamTop cannot be SAVED, but the MC speeded up the Alpha-Numeric printout to about one call sign per second. This means that the complete file can be printed out in alphabetical order in about 10 minutes (all ready to send to ARRL) at the end of Field Day. With both log and alpha-numeric list in hand, there's no need to save the file on tape.

I've included a listing of the MC (in decimal) and have also included a short program which can be used to input the MC (in decimal) by using programmed pokes. The first address (16414) on the MC listing is where the first character of the line 1 REM statement is. An easy way to reserve space in the REM statement is to fill it with numbers (like 1234567890 twenty times)(20x10=200). A small program for printing out the MC after it has been entered, is also included. This is useful to check for errors made during the MC input. Any errors found can be corrected with individual pokes. The Basic portion of the program can be entered in the usual way.

To use the program, first reserve the file space above RamTop by: poke 16388,42 - poke 16389,109 - then NEW. Now the program can be loaded (load LOGGER). The screen will come up with a menu called PROGRAM BRANCH. Since RUN clears all variables and program line 12 clears the Call Sign file, it is desirable to RUN only at the very beginning to get things initialized. To make sure that RUN is not selected accidentally, it is not one of the menu choices. To RUN, the program (at start only), use choice 0, this "quits" the program. Now you can RUN.

After RUN the Wave Band menu comes up. Following the prompts as they appear will allow you to use the program. However, several alternatives are possible when the TYPE CALL SIGN display is up. They are:

Enter call sign (4-6 characters)
Goto Wave Band menu (B then ENTER)
Goto Mode selection (M then ENTER)
Goto PROGRAM BRANCH (PB then ENTER)
Delete last call sign (D then ENTER)
Display present Time (just ENTER)

"Delete" is more useful than first supposed. Instead of merely deleting the last call sign printed, a call sign entered earlier can be deleted by entering the call sign that it is desired to delete. The screen will show "Duplicate", now enter D. That call sign will be deleted from the file and DELETED (call sign) and its file sequence number will be LPrinted on the current print line.

The real time clock is the same as described in the July issue. It could be simplified somewhat now that I'm into machine coding, but it works OK as is so I'm not about to change it. The program may be run without the hardware clock, but to keep from messing up the printout, program line 350 should be changed so that all STR$'s become CHR$'s. This will give /4:44 where ever the time is called.

Here are a few suggestions for anyone setting up a ZX81/TS1000 for Duping/Logging in a Field Day environment:

Since the printer, hard clock, and 16K memory unit are plugged in cascade into the computer, be sure to have a method of holding them together (without buckling). Also make sure that the printer and computer have no relative movement between them.

The monitor and printer can be powered by the Field Day generator but the computer should be supplied by an uninterruptible source. I use my travel trailer's 12 volt battery through a 7808T regulator IC with adequate heat sink.

Avoid ground loops with the transmitting and receiving equipment. I ran one ground for the radio gear and another one for the computing equipment.

Good luck on Field Day!

80 METERS

15:37	W0EWR	2A	MO	SSB	1
15:37	W9YIU	3A	WISC	SSB	2
15:38	W1AW	5D	CONN	SSB	3
15:39	N4RQF	2A	NCAR	SSB	4
15:40	W8LXE	3A	MI	SSB	5
15:40	AA8Z	3A	OH	SSB	6
15:40	KB8DER	3A	W VA	SSB	7
15:41	WD8QMR	1D	MI	SSB	8
15:41	K8BTH	2A	MI	SSB	9
15:42	KP4AQI	1D	OH	SSB	10
15:43	W5CH	2A	MISS	SSB	11
15:43	AF8E	2A	W VA	SSB	12
15:44	VE2BUI	2A	QUE	SSB	13
15:44	W0DER	3A	COLO	SSB	14
15:45	VE3SED	2A	ONT	SSB	15
15:45	WB8SRO	3A	OH	SSB	16
15:45	W8QMR	4A	MI	SSB	17
15:46	KA8BAK	1D	OH	SSB	18

80 METERS- W1AW
KP4AQI
N4RQF
W5CH
AA8Z
AF8E
K8BTH
KA8BAK
KB8DER
W8LXE
W8QMR
WB8SRO
WD8QMR
W9YIU
W0DER VE2BUI
W0EWR VE3SED

THIS ROUTINE IS FOR ENTERING MACHINE CODE (IN DECIMAL) INTO REM L (200 CHARACTERS)

```
700 LET V=16514
702 FAST
704 PRINT V;
706 INPUT U
708 POKE V,U
710 PRINT TAB 8;U
712 LPRINT V;TAB 8;PEEK V
714 LET V=V+1
716 IF V<16714 THEN GOTO 702
718 GOTO 200
720 STOP
```

THIS IS FOR PRINTING OUT THE MACHINE CODE IN REM L. IT'S IN DECIMAL, OF COURSE

(B)

```
700 LET V=16514
702 FAST
704 LPRINT V;TAB 8;PEEK V
706 LET V=V+1
708 IF V<16714 THEN GOTO 704
720 STOP
```

THIS IS A ROUTINE FOR TESTING CALL SIGN FILE ACCESS TIMING AND ALPHA PRINTOUT TIME. IT PUTS 595 CALL SIGNS (ALL WD9QMR) INTO THE FILE.

```
700 LET V=27945
702 FAST
704 DIM T$(8)
706 LET T$="259WD0MR"
708 LET U=1
710 POKE (V+U),CODE T$(U)
712 LET U=U+1
714 IF U<9 THEN GOTO 710
716 LET V=V+8
718 IF V<32705 THEN GOTO 708
720 GOTO 200
722 STOP
```

```
  1 REM Y 5E7*AT (77$4 CLS ▌4 S
AVE "TAN 5E7) FOR ■* ▒▒6 CLS ■,■4▒
(7▌4 RUN "*TAN Y E CLS ■4,■ "TA
N 7$4 UNPLOT Y REM ■4CHR$ Y■4SG
N *▌ TAN *▒ 5 FOR ■GOSUB 7 CLS ■
GOSUB ■TAN Y E CLS ■?TAN Y E CLE
AR ■6 CLS ■4,* TAN ) FOR ■* ▒
GOSUB ■6 CLS ■Y ■CV) FOR ■ ▒ Y I
F LINKEY$4■7($4 POKE / FAST 5 FO
R ■) NEXT ■ ▒ GOSUB ■E CLS ■) FO
R ■ ▒ GOSUB ■5 NEXT ■GOSUB 7 CLS
■ ▒ GOSUB ■ FOR /77$4 UNPLOT /■
5 FOR ■GOSUB 7 CLEAR ■ ▒ GOSUB ■
 GOSUB 7 CLEAR ■* TAN
  2 REM "LOGGER" 12/84
  3 REM -BY W8NFQ-
  4 FAST
  5 LET O=0
  6 LET R$=" METERS"
  8 LET E$="  THEN ENTER"
  9 LET J=0
 12 LET T=USR 16514
 14 DIM D$(6,2)
 16 LET D$(1)="10"
 17 LET D$(2)="15"
 18 LET D$(3)="20"
 20 LET D$(4)="40"
 21 LET D$(5)="80"
 23 SLOW
 24 PRINT AT 2,0;D$(1);R$;"= 1"
,D$(4);R$;"= 4"
 26 PRINT AT 4,0;D$(2);R$;"= 2"
,D$(5);R$;"= 5"
 28 PRINT AT 6,0;D$(3);R$;"= 3"
 30 PRINT AT 9,0;"SELECT BAND (
NUMBER)";
 32 INPUT F$
 33 IF F$<"1" OR F$)"5" THEN GO
TO 32
 35 LET L=VAL F$
 36 PRINT AT 9,20;"---";D$(L);R
$
 39 SLOW
 40 PRINT AT 12,0;"SELECT MODE
(SSB OR CW)";
 42 INPUT G$
 43 IF G$<>"SSB" AND G$<>"CW" T
HEN GOTO 42
 45 PRINT AT 12,23;"---";G$
 47 GOTO 50
 48 CLS
 49 PRINT
 50 PRINT
 51 PRINT
 52 SLOW
 53 DIM A$(8)
 54 PRINT TAB 6;"TYPE CALL SIGN
"
 56 INPUT Z$
 57 FAST
 58 CLS
 60 IF Z$="B" THEN GOTO 80
 62 IF Z$="M" THEN GOTO 30
 64 IF Z$="PB" THEN GOTO 199
 66 IF Z$="D" THEN GOTO 290
 68 IF Z$="" THEN GOSUB 330
 70 IF Z$="" THEN GOTO 49
 71 IF LEN Z$)6 THEN GOTO 49
 72 LET Z$=Z$+"      "
 74 LET Z$=Z$(1 TO 6)
 76 IF Z$(4 TO 6)="   " THEN GO
TO 49
 78 LET A$(2)=STR$ L
 79 LET A$(1)="1"
 80 IF G$="CW" THEN LET A$(1)="
2"
 82 LET A$(3 TO 8)=Z$(1 TO 6)
 84 DIM B$(6)
 86 IF A$(3)<>"A" AND A$(3)<>"K
" AND  A$(3)<>"N" AND A$(3)<>"W"
THEN GOTO 104
 88 IF A$(4)>"9" THEN GOTO 96
 90 LET B$(1)=A$(4)
 91 LET B$(2)=A$(3)
 92 LET B$(3)="
 93 LET B$(4 TO 6)=A$(5 TO 7)
 94 GOTO 102
 96 LET B$(1)=A$(5)
 98 LET B$(2 TO 3)=A$(3 TO 4)
100 LET B$(4 TO 6)=A$(6 TO 8)
102 LET A$(3 TO 8)=B$(1 TO 6)
103 IF A$(3)="0" THEN LET A$(3)
="A"
104 LET B$=Z$
105 LET U=32746
106 FOR K=1 TO 8
108 POKE U+K,CODE A$(K)
110 NEXT K
112 LET T=USR 16531
113 IF T=1 THEN GOTO 120
114 IF T=3 THEN GOTO 130
115 IF T=5 THEN GOTO 190
116 STOP
120 GOSUB 180
121 SLOW
122 PRINT AT 3,8;"DUPLICATE"
123 PRINT AT 5,3,Z$;" ";J,D$(L)
R$
125 PRINT
126 GOTO 49
128 STOP
130 SLOW
131 PRINT AT 3,3;"CALL";TAB 11;
"CLASS";TAB 19;"SECTION"
132 PRINT AT 5,3;Z$
134 INPUT H$
135 IF H$="" THEN GOTO 48
136 IF LEN H$)3 THEN GOTO 134
137 PRINT AT 5,12;H$
139 INPUT I$
140 IF I$="" THEN GOTO 48
141 IF LEN I$)4 THEN GOTO 139
142 PRINT AT 5,20;I$
144 PRINT AT 10,8;"QSO COMPLETE
D ?"
146 PRINT AT 13,0;"IF YES- ANY
 L/N KEY ";E$
148 PRINT AT 16,0;"IF NO- ENTER
"
150 INPUT F$
152 FAST
154 IF F$="" THEN GOTO 48
156 CLS
158 LET T=USR 16585
159 GOSUB 180
160 IF O=L THEN GOTO 166
161 LPRINT
163 LPRINT TAB 10;D$(L);R$
164 LPRINT
165 LET O=L
166 GOSUB 330
168 LPRINT N$;TAB 7;Z$;TAB 15;H
$;TAB 19;I$;TAB 24;G$;TAB 29;J
170 PRINT AT 3,0;Z$;TAB 7;J;TAB
 11;D$(L);R$
172 GOTO 49
180 LET U=PEEK 32763+256*PEEK 3
2764
182 LET J=(U-27938)/8
184 RETURN
190 SLOW
191 PRINT AT 11,9;"FILE FULL"
192 STOP
198 CLS
200 SLOW
201 PRINT AT 2,0;"PROGRAM BRANC
H";AT 5,0;"TO RESUME-";TAB 17;"
R";E$;AT 8,0;"TO ALPHA PRINT-";T
AB 17;"P";E$
202 PRINT AT 11,0;"TO SET CLOCK
-";TAB 17;"S";E$;AT 14,0;"TO SAV
E ON TAPE-";TAB 17;"T";E$
203 PRINT AT 17,0;"TO QUIT PROG
RAM-";TAB 17;"Q";E$
205 INPUT Z$
206 IF Z$<>"P" AND Z$<>"Q" AND
Z$<>"R" AND Z$<>"S" AND Z$<>"T"
THEN GOTO 205
207 FAST
208 IF Z$="R" THEN GOTO 48
210 IF Z$="P" THEN GOTO 380
212 IF Z$="S" THEN GOTO 228
213 IF Z$="T" THEN GOTO 600
214 IF Z$="Q" THEN GOTO 522
216 STOP
228 CLS
229 SLOW
230 PRINT AT 4,0;"SET CLOCK (4
DIGITS)"
231 GOSUB 300
234 IF NOT LEN X$=4 THEN GOTO 2
30
236 IF X$<"0000" THEN GOTO 230
238 IF X$(1 TO 2)>"23" OR X$(3
TO 4)>"59" THEN GOTO 230
239 FAST
240 DIM M(6)
242 LET M(6)=VAL X$(1)
243 LET M(5)=VAL X$(2)
244 LET M(4)=VAL X$(3)
245 LET M(3)=VAL X$(4)
246 LET M(2)=0
247 LET M(1)=0
250 PRINT AT 4,20;"--";M(6);M(5
);":";M(4);M(3);AT 6,0;"TO START
- ENTER"
251 SLOW
252 GOSUB 300
254 IF X$<>"" THEN GOTO 252
255 FAST
256 POKE 16383,128
258 POKE 16382,1
260 LET M(6)=M(6)+8
262 FOR K=1 TO 6
264 LET S=K-1
266 POKE 16380,S
267 POKE 16381,M(K)
268 POKE 16382,3
269 POKE 16382,1
270 NEXT K
272 POKE 16382,0
274 POKE 16383,0
276 GOTO 48
278 STOP
290 IF J=0 THEN GOTO 48
292 LET T=USR 16598
293 LPRINT TAB 6;"DELETE  ";B$;
TAB 22;J
294 SLOW
295 PRINT AT 3,5;B$;" ";J;"  DE
LETED"
296 LET J=0
297 GOTO 49
298 STOP
300 PRINT AT 19,0;"TO CANCEL-";
TAB 17;"C";E$
302 INPUT X$
304 IF X$="C" THEN GOTO 198
306 RETURN
308 STOP
330 DIM M(6)
332 POKE 16383,130
334 POKE 16382,1
336 POKE 16382,5
338 FOR K=2 TO 5
340 POKE 16380,K
342 LET M(K)=PEEK 16381
344 NEXT K
345 POKE 16382,0
348 LET M(5)=M(5)-8
350 LET N$=STR$ M(5)+STR$ M(4)+
":"+STR$ M(3)+STR$ M(2)
352 PRINT AT 3,22;N$
354 RETURN
356 STOP
380 CLS
382 SLOW
384 PRINT AT 3,0;"ALPHA-NUMERIC
 PRINT-OUT";AT 5,0;"TO START- EN
TER"
388 GOSUB 300
394 IF X$<>"" THEN GOTO 388
396 FAST
398 CLS
399 LET C=0
400 LET O=0
401 LET Y=0
402 POKE 32765,42
404 POKE 32766,109
408 LET T=USR 16605
410 IF T=2 THEN GOTO 514
412 IF T=4 THEN GOTO 416
414 STOP
416 DIM P$(8)
418 LET U=32746
420 FOR K=1 TO 8
422 LET P$(K)=CHR$ PEEK (U+K)
424 NEXT K
426 IF P$(3)="A" THEN LET P$(3)
="0"
428 IF P$(3)>"9" THEN GOTO 450
429 LET V=1
430 IF P$(5)=" " THEN GOTO 440
432 LET B$(1 TO 2)=P$(4 TO 5)
434 LET B$(3)=P$(3)
436 LET B$(4 TO 6)=P$(6 TO 8)
438 GOTO 454
440 LET B$(1)=" "
442 LET B$(2)=P$(4)
444 LET B$(3)=P$(3)
446 LET B$(4 TO 6)=P$(6 TO 8)
448 GOTO 454
450 LET B$(1 TO 6)=P$(3 TO 8)
451 LET V=2
452 IF B$(2)<="9" THEN LET B$(1
TO 6)=" "+B$(1 TO 5)
454 LET W=VAL P$(1)
456 LET L=VAL P$(2)
458 IF O=L AND Y=V AND C=W THEN
GOTO 474
460 LPRINT
462 LET Y=V
464 LET C=W
466 IF O=L THEN GOTO 474
470 LPRINT D$(L);R$;"-";
472 LET O=L
474 LPRINT TAB 11;B$;
476 IF P$(1)="2" THEN LPRINT TA
B 18;"CW"
478 IF P$(1)="1" THEN LPRINT "
"
480 GOTO 408
482 STOP
514 SLOW
515 CLS
518 PRINT AT 9,6;"RUN COMPLETED
"
522 PRINT
523 PRINT
524 PRINT TAB 4;"PROGRAM IS STO
PPED"
526 STOP
600 CLS
602 SLOW
604 PRINT AT 3,0;"SAVE PROGRAM
AND FILE";AT 6,0;"START CASSETTE
 (RECORD + PLAY)-";AT 9,0;E$
608 GOSUB 300
612 IF X$<>"" THEN GOTO 608
614 CLS
616 SAVE "LOGGER"
620 GOTO 200
622 STOP
```

THIS IS A PRINT OUT OF THE MACHINE CODE (IN DECIMAL) WHICH IS IN REM 1 (ROUTINE (B))

```
16514   62      16595   237
16515   0       16596   176
16516   33      16597   201
16517   40      16598   62
16518   109     16599   0
16519   1       16600   42
16520   149     16601   251
16521   149     16602   127
16522   119     16603   119
16523   35      16604   201
16524   13      16605   62
16525   32      16606   0
16526   251     16607   42
16527   201     16608   253
16528   62      16609   127
16529   0       16610   205
16530   201     16611   251
16531   33      16612   127
16532   42      16613   119
16533   109     16614   62
16534   17      16615   4
16535   235     16616   1
16536   127     16617   2
16537   1       16618   0
16538   0       16619   201
16539   0       16620   17
16540   34      16621   235
16541   251     16622   127
16542   127     16623   1
16543   205     16624   0
16544   160     16625   0
16545   32      16626   237
16546   0       16627   176
16547   19      16628   34
16548   35      16629   251
16549   0       16630   127
16550   32      16631   62
16551   247     16632   0
16552   14      16633   190
16553   1       16634   40
16554   201     16635   59
16555   62      16636   17
16556   0       16637   235
16557   42      16638   127
16558   251     16639   14
16559   127     16640   8
16560   190     16641   26
16561   32      16642   190
16562   4       16643   250
16563   1       16644   49
16564   0       16645   65
16565   0       16646   32
16566   201     16647   7
16567   35      16648   35
16568   13      16649   19
16569   32      16650   10
16570   252     16651   32
16571   222     16652   244
16572   234     16653   24
16573   189     16654   229
16574   32      16655   33
16575   214     16656   235
16576   62      16657   127
16577   127     16658   17
16578   188     16659   243
16579   32      16660   127
16580   209     16661   14
16581   1       16662   8
16582   5       16663   237
16583   0       16664   176
16584   201     16665   42
16585   1       16666   251
16586   8       16667   127
16587   0       16668   17
16588   33      16669   235
16589   235     16670   127
16590   127     16671   14
16591   237     16672   8
16592   91      16673   237
16593   251     16674   176
16594   127     16675   33
                16676   243
```

```
16677   127
16678   201
16679   14
16680   251
16681   127
16682   42
16683   251
16684   127
16685   237
16686   176
16687   201
16688   62
16689   55
16690   50
16691   92
16692   251
16693   24
16694   189
16695   33
16696   235
16697   127
16698   237
16699   91
16700   253
16701   127
16702   14
16703   8
16704   237
16705   176
16706   237
16707   83
16708   253
16709   127
16710   1
16711   4
16712   0
16713   201
```

ANGLE OF RADIATION CALCULATIONS

---Murray Gordon---
VE1BRA

While experimenting with the G5RV wire antenna the question arose of what the best height for the antenna would be. Looking through the ARRL Antenna Handbook, Chapter 2 gives radiation lobes for various heights of horizontal antennas, wanting a little more versitility,here is a program to calculate angles of radiation (up to 4)given an antenna height and center frequency.

The program is self-starting and menu driven. Some improvements would be to plot the lobes,but I haven't taken the time as yet. The lobes are calculated based on a half-wave dipole. You could input a full-wave or quarter wave in Line 145, as desired.

By experimenting with various heights you can calculate an optimum angle of radiation,for your operation.

GOOD LUCK and HAVE FUN !

```
  5 REM "RADLOG"
 10 REM RADIATION LOBE CALCULAT
ION
 15 FOR I=1 TO 32
 16 PRINT "■";
 17 NEXT I
 20 PRINT AT 3,6;"ANGLE OF RADI
ATION"
 25 PRINT AT 4,3;"FOR A HORIZON
TAL ANTENNA"
 30 PRINT AT 6,0;" USING A HALF
-WAVE ANTENNA AS A REFERENCE,THE
 ANGLE OF RADIATIONIS CALCULATED
,ALONG WITH THE  OTHER SIGNIFI
CANT LOBES,"
 32 PRINT AT 11,0;" BY EXPERIME
NTING, ONE CAN  DETERMINE TH
E OPTIMUM HEIGHT FORTHE DESIRED
 OPERATION,"
 35 PRINT AT 15,2;"DATA REQUIRE
D IS"
 40 PRINT AT 16,2;"1.ANTENNA HE
IGHT (FT)"
 45 PRINT AT 17,2;"2.CENTER FRE
QUENCY (MHZ)"
 46 FOR T=1 TO 32
 47 PRINT "■";
 48 NEXT T
 50 PRINT AT 21,7;"PRESS ■ TO C
ONT."
 55 IF INKEY$="C" THEN GOTO 70
 60 IF INKEY$<>"C" THEN GOTO 55
 70 CLS
100 FOR U=1 TO 32
105 PRINT "-";
110 NEXT U
115 PRINT "          DATA INPUT:
          "
116 FOR U=1 TO 32
117 PRINT "-";
118 NEXT U
120 PRINT "ANTENNA HEIGHT ABOVE
"
121 PRINT "  GROUND (FT)
  =";
125 INPUT H
126 PRINT H
130 PRINT "CENTER FREQUENCY (MH
Z) =";
135 INPUT F
136 PRINT F
137 PRINT
138 PRINT '          RESULTS:
          "
140 LET D=180/PI
145 LET L=492/F
146 LET C=L/(4*H)
147 IF C<1 THEN GOTO 150
148 LET C=2-C
150 LET A1=ASN (C)
155 LET A1=INT (R1*D*100)/100
200 PRINT AT 9,0;"ANGLES OF RAD
IATION:"
205 PRINT
210 PRINT "FIRST LOBE ANGLE----
 ";A1;" DEG"
215 IF (4*H)<(3*L) THEN GOTO 60
0
220 LET A2=ASN ((3*L)/(4*H))
225 LET A2=INT (R2*D*100)/100
230 PRINT "SECOND LOBE ANGLE---
 ";A2;" DEG"
240 IF (4*H)<(5*L) THEN GOTO 60
0
250 LET A3=ASN ((5*L)/(4*H))
260 LET A3=INT (R3*D*100)/100
265 PRINT "THIRD LOBE ANGLE----
 ";A3;" DEG"
270 IF (4*H)<(7*L) THEN GOTO 60
0
275 LET A4=ASN ((7*L)/(4*H))
280 LET A4=INT (R4*D*100)/100
290 PRINT "FOURTH LOBE ANGLE---
 ";A4;" DEG"
600 PRINT AT 18,2;"NO OTHER SIG
NIFICANT LOBES"
610 PRINT AT 20,0;"DO YOU WANT
ANOTHER DESIGN?(Y/N)"
620 IF INKEY$="Y" THEN GOTO 70
630 IF INKEY$="N" THEN GOTO 650
640 IF INKEY$<>"N" THEN GOTO 62
0
650 STOP
700 SAVE "RADLOB"
710 RUN
```

Sample Print-out:

```
    ANGLE OF RADIATION
  FOR A HORIZONTAL ANTENNA

 USING A HALF-WAVE ANTENNA AS A
REFERENCE,THE ANGLE OF RADIATION
IS CALCULATED,ALONG WITH THE
OTHER SIGNIFICANT LOBES.

 BY EXPERIMENTING, ONE CAN
DETERMINE THE OPTIMUM HEIGHT FOR
THE DESIRED OPERATION.

  DATA REQUIRED IS:
  1.ANTENNA HEIGHT (FT)
  2.CENTER FREQUENCY (MHZ)

       PRESS ■ TO CONT.
```

```
------------------------------
          DATA INPUT:
------------------------------
ANTENNA HEIGHT ABOVE
  GROUND (FT)          =100
CENTER FREQUENCY (MHZ) =3.75

          RESULTS:

ANGLES OF RADIATION:

FIRST LOBE ANGLE---- 19.14 DEG
SECOND LOBE ANGLE--- 79.73 DEG
```

BROTHER EP-44 TYPEWRITER/PRINTER DETAILED REVIEW
by
Kraig D. Pritts-KA2LHO

The Brother EP-44 typewriter/printer is a letter quality dot-matrix printer which is small, lightweight, and packed full of features. The printer has been on the market for about a year now and it looks like it is one of the best buys around for the portable printer market. As a printer it produces excellent quality printout (as evidenced by this article) via a 24x18 dot matrix printhead. Its print speed will not astound you at 16 characters per second, but if you are willing to wait, the printer will do the job. You can use thermal paper (without a ribbon) or smooth plain paper with the thermal transfer ribbon (they cost about $3.00 each). Rough, bond type paper does not work well on thermal transfer type printers. Included as a standard feature on the EP-44 is an RS-232C interface which allows connection to most popular computers, including the TIMEX/Sinclair family. This interface is a two-way connection. By this I mean that data can be sent to, received and printed by the printer and data can also be sent from the printer to a modem, computer, or daisy wheel typewriter with RS-232 interface to enable additional typestyles. A variety of configurations is available for the interface but the ones that have worked best for me are shown below:

FOR 2068 AND TASMAN SERIAL INTERFACE
Baud-110
Bit Length-8
Parity-N
New Line-CR+LF
Code-8
ER-Y

FOR TS 1000 AND MEMOTECH RS-232 INTERFACE
Baud-300
Bit Length-7
Parity-Z
New Line-CR+LF
Code-8
ER-Y

The printer will operate from 4 'D' size batteries as well as AC house current and only weighs 5.5 lbs. (including batteries). Print width is up to 80 columns and the printer will accept fan-fold type paper provided the tractor feed edges are removed first.

Now, about the typewriter! I have rarely seen so many features packed into a neat and relatively inexpensive package as this. The typewriter uses 44 keys of the same type found on the TIMEX/Sinclair 2068. As on the Sinclair computers, many of the keys have more than one function and are accessed by use of certain key combinations. In addition to most traditional typewriter functions, this machine also includes automatic line return (without pressing return), automatic right margin flush, auto-centering, automatic underlining, and numerous foreign language symbols. The keyboard also provides access to a calculator which uses the add, subtract, multiply, and divide functions and will provide printout of everything if desired. There is a 15 character pre-print display and correction buffer with your choice of making that a full line correction if desired. Probably the most interesting aspect of this typewriter, however, is the 4K text memory. This is in fact a mini-word processor which allows you to enter text, edit it, append to it, or delete it as you desire. Movement throughout the text memory can be made line by line or character by character as you choose. Printout of the memory can be made to paper or just through the display if desired. This can be a handy tool to use when using the EP-44 in a portable situation. Don't worry about losing all of your text if you have to change batteries! According to the manual, the memory will remain intact for up to approximately one hour without any power applied. This allows time to change batteries (even to run to the store and get some, if needed). In order to conserve batteries, Brother has added an auto-off feature which automatically shuts off the typewriter after about 10 minutes of no use.

The Brother EP-44 sells for about $299.95 but can often be found discounted for much less than that. I am very pleased with my investment which provides a letter quality printout unequalled by most "letter quality dot matrix" printers without the price tag to match the fully formed daisy wheel printers. In addition, I get the features of a typewriter with lots of extra goodies. The EP-44 is a perfect match for the TIMEX/Sinclair family of computers. This review was written using a TS 2068, Tasman Serial Interface, Tasword II word processor, and the Brother EP-44 typewriter/printer.

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Gift From Gods	14.95/was	19.95
Trashman	12.95/was	14.95
Scuba Dive	12.95/was	14.95
Beach-head	14.95/was	17.95
Ant Attack	10.95/was	14.95
Omnicalc2	19.95/was	24.95
Deus Ex Machina	21.95/was	25.95
LodeRunner	14.95/was	16.95

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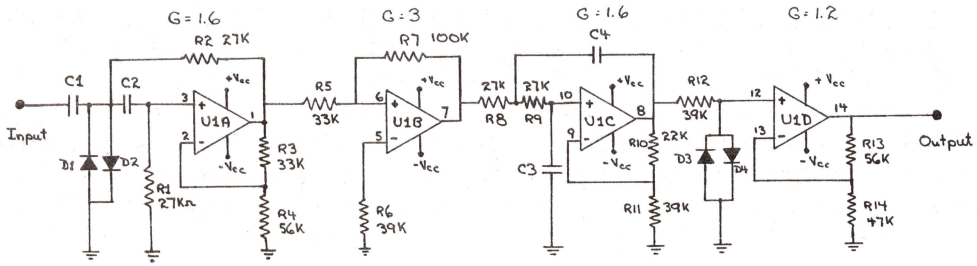
RAID OVER MOSCOW

CURRY COMPUTER GLENDALE
5344 W. BAYFF LN AZ 85306

Offer good til April 15, 1985

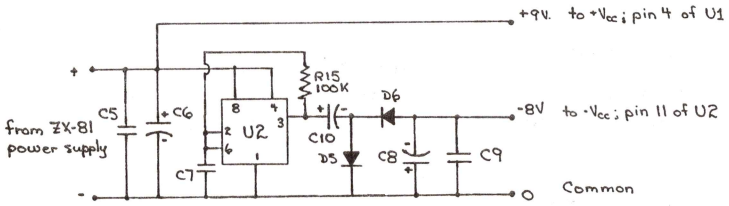
"Q-Save Filter" - VE1BRA

A/ Schematics:



High-Pass Filter
2-Pole; Butterworth

Low-Pass Filter
2-Pole : Butterworth.



B. Components:

1. Resistors: 1/4 Watt 5%

R1, R2, R8, R9	27K
R3, R5,	33K
R4, R13	56K
R6, R11, R12	39K
R7, R15	100K
R10	22K
R14	47K

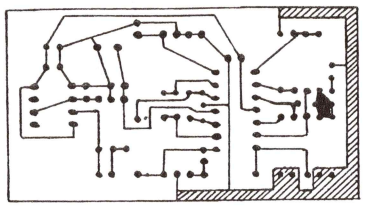
2. Capacitors:

C1, C2, C3, C4	2.7nF
C5, C9	.047μF
C6, C8	22μF (electro)
C7	.001μF
C10	10μF (electro)

3. Diodes: D1 - D6 IN914

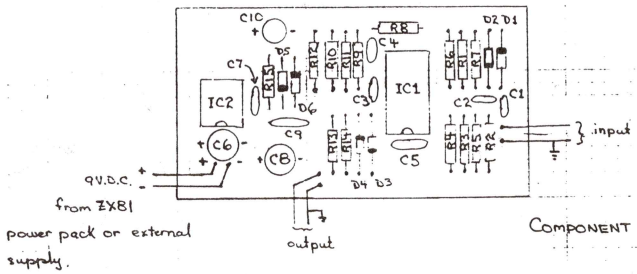
4. ICs: U1 .... 3403 Quad Op Amp
U2 .... 555 Timer

5. Hardware: 1 - 8 pin Low Profile Socket
1 - 14 pin Low Profile Socket
4 - 1/8" phono jacks.



Foil Layout: "Q-Save" Filter

Construction Notes:
1. Observe the polarity markings on the small signal diodes. (especially D5 and D6)
2. Observe the polarity markings on the electrolytics.



Component Layout:

Color Codes:

R1, R2, R8, R9,	27KΩ	Red Violet Orange.
R3, R5	33KΩ	Orange Orange Orange
R4, R13	56KΩ	Green Blue Orange
R6, R11, R12	39KΩ	Orange White Orange
R7, R15	100KΩ	Brown Black Yellow
R10	22KΩ	Red Red Orange
R14	47KΩ	Yellow Violet Orange.

SPECIFICATIONS: "Q-SAVE FILTER"

Filter type: 2-pole Butterworth; Bandpass using a low and high pass sections using a 3403 Quad Op Amp. ; Center frequency = 2.2KHz

System Gain: 7.4 Gain of U1A = 1.6 ; U1B = 3 ; U1C = 1.6 ; U1D = 1.2.

Filter Characteristic: f_c = 2.2 KHz 3db points are 1400 and 3500 Hz @ 60Hz = 45 db down. (see Fig 5.).

Power: Input: +9 V.D.C.
555 Timer Output = -7.5 V.D.C with 9-10 V.D.C. input.
- this is used for negative voltage supply
- frequency of the 555 set for 6.1KHz with 60/40% duty cycle

Frequency Determination:

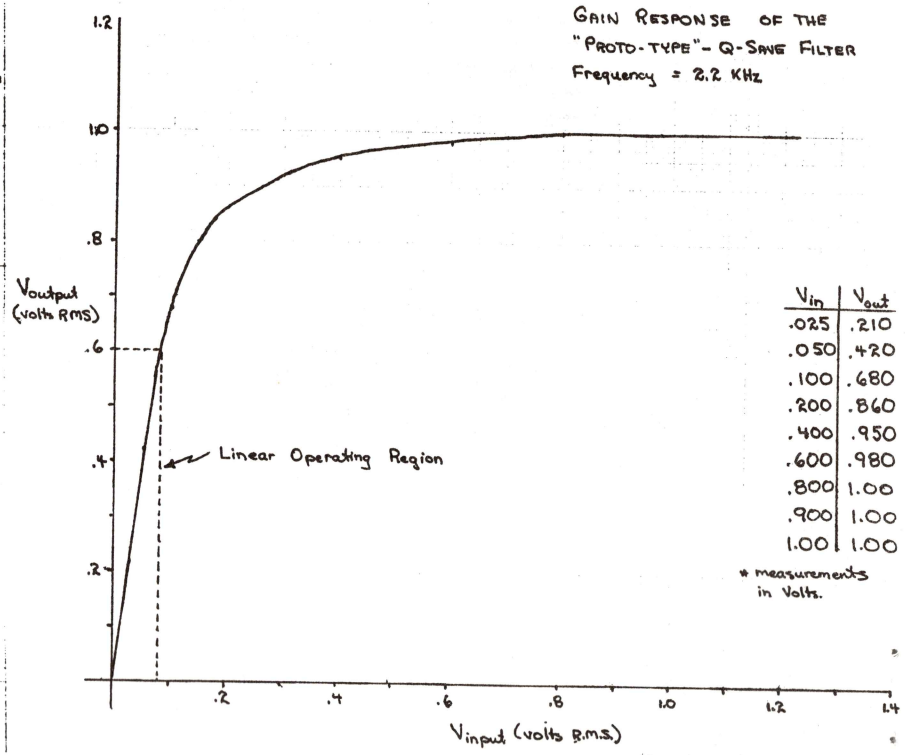
1. Filter: $f_c = \frac{1}{2\pi RC}$ where R = 27KΩ and C = 2.7nF
= 2.2KHz.

2. 555: $\tau = RC$ where R = 100KΩ and C = .001MF
$= 1 \times 10^{-4}$
$f = \frac{1}{\tau} \simeq 10KHz.$ i.e. frequency = 10KHz

TASPRINT SAMPLE, KADLHO

Lectura Light print style is very clean and straightforward while **Median style gives a very business-like printout. Compacta is very good for titles and bold-face printing while** Palace Script provides a printout that is indeed unique among dot-matrix printers on the low end price range. DATA RUN PRINTING ALSO PROVIDES SOME ORIGINALITY AND UNIQUENESS TO ONES PRINTING CAPABILITIES. Underlining is a possibility as well as boxed words. **Perhaps the most unique print style is the ability to have inverse printing where desired.**

GAIN RESPONSE OF THE "PROTO-TYPE" - Q-SAVE FILTER
Frequency = 2.2 KHz



V_{in}	V_{out}
.025	.210
.050	.420
.100	.680
.200	.860
.400	.950
.600	.980
.800	1.00
.900	1.00
1.00	1.00

* measurements in Volts.

OPERATING DATA:
1. Power Supply Operating Frequency = 6.14 KHz
2. Output Voltage = -7.5 V.D.C.

```
  5 REM HAM RADIO 1/85 WB0IKN/TS2068 BY WA6DLI
 10 BORDER 1: PAPER 1: INK 7: CLS
 12 POKE 23658,8
 15 PRINT  AT 12,5;"GAMMA MATCH DESIGN"
 20 PRINT  AT 13,5;"BY RICHARD A. NELSON"
 25 PRINT  AT 15,5;"TS2068 TRANSLATION: WA6DLI"
 30 PAUSE 300
 32 CLS
 35 PRINT
 50 DEF FN C(X)= LN (X+ SQR (X*X-1))
 60 PRINT "ENTER <M>  OR <D>"'" FOR MONOPOLE  OR DIPOLE"
 70 INPUT A$
 80 IF A$="M" OR A$="D" THEN  GO TO 100
 90 GO TO 32
100 INPUT "ENTER FREQ IN MHZ =";F
110 INPUT "ENTER FEEDPOINT RESISTANCE =";RA
120 IF A$="D" THEN  LET RA=RA/2
130 INPUT "FEEDPOINT REACTANCE =";XA
140 IF A$="D" THEN  LET XA=XA/2
150 INPUT "ENTER FEEDLINE RESISTANCE";RO
160 PRINT : PRINT
170 PRINT "(THE FOLLOWING ARE IN INCHES)"
180 PRINT
185 INPUT "ENTER DRIVEN ELEMENT DIAMETER";DE
190 INPUT "ENTER GAMMA ROD DIAMETER";DG
200 INPUT "ENTER GAMMA ROD SPACING";S
210 LET HZ=(1+(( FN C((4*S*S-DE*DE+DG*DG)/(4*S*DG)))/( FN C((4*S*S+DE*DE-DG*DG)
/(4*S*DE)))))^2
220 LET ZO=60* FN C((4*S*S-DE*DE-DG*DG)/(2*DE*DG))
230 LET T=HZ/ZO
240 LET A=((RO*XA)/(HZ*RA-RO))
250 LET B=(RO*((RA)^2+(XA)^2))/(HZ*RA-RO)
260 LET Q=A+ SQR (A*A+B)
270 LET XS=HZ*((RO*XA+ SQR ((RO*XA)^2+RO*(HZ*RA-RO)*((RA)^2+(XA)^2)))/(HZ*RA-RO
))
280 LET LDGA= ATN (Q*T)
290 LET LDG=(LDGA*360)/(2* PI )
300 LET E=(RO/RA)*(((RA)^2+(XA)^2)/Q)
310 LET G=(RO/RA)*XA
320 LET CR=1000000/(2* PI *(E+G)*F)
330 CLS
340 IF A$="D" THEN  LET RA=RA*2: IF A$="D" THEN  LET XA=XA*2
350 PRINT
360 IF A$="D" THEN  PRINT "DIPOLE ANTENNA:"
370 IF A$="M" THEN  PRINT "MONO-POLE ANTENNA:"
380 PRINT
390 PRINT "FREQUENCY (MHZ) = ";F
400 PRINT "DRIVEN ELEMENT DIAM = ";DE
410 PRINT "GAMMA ROD DIAM = ";DG
420 PRINT "GAMMA ROD SPACING = ";S
430 PRINT "DRIVEN ELEMENT RESISTANCE = ";RA
440 PRINT "DRIVEN ELEMENT REACTANCE = ";XA
450 PRINT "FEEDLINE RESISTANCE = ";RO
460 PRINT
470 PRINT "GAMMA LENGTH(DEGREES)= ";LDG
480 LET FT=(948/F)*(LDG/360): PRINT "GAMMA LENGTH (FEET)= ";FT
490 LET IN=FT*12: PRINT "GAMMA LENGTH (INCHES)= ";IN
500 LET CM=IN*2.54: PRINT "GAMMA LENGTH (CM)= ";CM
510 PRINT "GAMMA CAP IN PF= ";CR
520 PRINT "WANT COPY Y/N?"
525 INPUT Y$
530 IF Y$(1)="Y" THEN  COPY
531 IF Y$(1)="Y" THEN  RANDOMIZE  USR 64716
535 PRINT "WANY ANOTHER CALCULATION Y/N?"
540 INPUT Y$
550 IF Y$="Y" THEN  GO TO 5
560 STOP
600 SAVE "GAMMA" LINE 1
```

GAMMA MATCH:

```
DIPOLE ANTENNA:

FREQUENCY (MHZ) = 14.2
DRIVEN ELEMENT DIAM = 1.5
GAMMA ROD DIAM = 0.25
GAMMA ROD SPACING = 3
DRIVEN ELEMENT RESISTANCE = 40
DRIVEN ELEMENT REACTANCE = 15
FEEDLINE RESISTANCE = 50

GAMMA LENGTH(DEGREES)= 29.478583
GAMMA LENGTH (FEET)= 5.4666856
GAMMA LENGTH (INCHES)= 65.600227
GAMMA LENGTH (CM)= 166.62458
GAMMA CAP IN PF= 114.75559
WANT COPY Y/N?
```

```
DIPOLE ANTENNA:

FREQUENCY (MHZ) = 14.2
DRIVEN ELEMENT DIAM = 1.5
GAMMA ROD DIAM = 0.5
GAMMA ROD SPACING = 3
DRIVEN ELEMENT RESISTANCE = 20
DRIVEN ELEMENT REACTANCE = 7.5
FEEDLINE RESISTANCE = 50

GAMMA LENGTH(DEGREES)= 38.340587
GAMMA LENGTH (FEET)= 7.1101089
GAMMA LENGTH (INCHES)= 85.321307
GAMMA LENGTH (CM)= 216.71612
GAMMA CAP IN PF= 262.10059
WANT COPY Y/N?
```

```
DIPOLE ANTENNA:

FREQUENCY (MHZ) = 14.2
DRIVEN ELEMENT DIAM = 1.5
GAMMA ROD DIAM = 0.25
GAMMA ROD SPACING = 6
DRIVEN ELEMENT RESISTANCE = 20
DRIVEN ELEMENT REACTANCE = 7.5
FEEDLINE RESISTANCE = 50

GAMMA LENGTH(DEGREES)= 25.319382
GAMMA LENGTH (FEET)= 4.6953783
GAMMA LENGTH (INCHES)= 56.34454
GAMMA LENGTH (CM)= 143.11513
GAMMA CAP IN PF= 241.89398
WANT COPY Y/N?
```

73, W4GHV & K5XY

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```
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